CHAPTER I
INTRODUCTION

At present a large amount of petroleum fuel oil are consumed in many countries, especially gasoline which consists of 2 types: premium motor gasoline (octane number 95), which is yellow; and regular motor gasoline (octane number 91), which is red. In general, gasoline fuel has no color but manufacturer regularly mix dye into it to identify various grades of gasoline, to distinguish manufacturer's brands and in some cases to make adulteration.

In general, most of commercial azo dyes for using in petroleum products are expensive and exhibit low solubility in petroleum products. Example of commercial dyes are Solvent Yellow 56, Solvent Yellow 14, Solvent Red 19 and Solvent Red 24, and Solvent Blue 36 [1].

Desirable properties of dyes used as coloring agent for petroleum products are simple synthetic procedures, high molar extinction coefficients, high soluble in organic solvents and fuel oil, low cost, medium-to-high fastness properties with respect to both light and wetness during storage and high stability in fuel.

Azo dyes constitute the largest single class of dyes in use and find broad application in textiles, paper, leather, petroleum products, foodstuffs and cosmetics. They are commonly prepared by coupling a diazotized aromatic amine with a phenol or aromatic amine. Cardanol is a natural alkyl phenol obtained from cashew nut shell liquid (CNSL), which is commonly available in the southern part of Thailand. It is an inexpensive natural raw material bearing a long hydrocarbon chain, which enables the enhanced solubility in organic solvent and petroleum product. In 1964, Pansare *et al.* synthesized mono and disazo dyes from hydrogenated cardanol and various aromatic amines. An advantage of the presence of long alkyl side chain of cardanol is improving solubility in oil, penetration in leather and water-repellance [2]. In 2004, Suwanprasop *et al.* synthesized monoazo dyes from cardanol and aniline derivatives for marker dyes in gasoline and high-speed diesel [3].

This research also involves the use of locally available cardanol as a solubilizing and inexpensive precursor for synthesis of a highly soluble disazo dye as coloring agent for gasoline fuel. The disazo dyes can be synthesized from coupling reaction of diazotized aromatic diamine and cardanol. The presence of two azo groups in molecular structure is expected to shift the absorption maximum of the compounds to longer wavelength. Moreover, the investigation of effects of aromatic amine group on dye formation, solubility and photophysical behavior (absorption and molar absorptivity) of the disazo compounds will be also performed. The stability of the dye in the gasoline fuel will be examined to evaluate the possibility of the dyes for being used commercially.

1.1 Objectives of this research

The objectives of this research are synthesizing red disazo dye from cardanol and aromatic diamine as coloring agent for gasoline 91 and evaluation of its performance as a dye in the commercial use.

1.2 Scope of this research

The scope of this research covers the synthesis of disazo dyes from cardanol and aromatic diamines, including benzidine, 1,5-diamino-naphthalene, *o*-phenylenediamine, *m*-phenylenediamine, *p*-phenylenediamine, 2-nitro-1,4-phenylenediamine, 4-amino-*N,N*-dimethyl-anilne, 1-naphthylamine and 4-nitro-1-naphthylamine, as gasoline dyes. These dyes were fully characterized by spectroscopic techniques such as mass spectrometry, and FT-IR, ^{1}H-NMR, ^{13}C-NMR and UV-Visible spectroscopy. In addition, physical properties of gasoline dyed by the selected red disazo compound and the stability of the red azo dye in petroleum fuel were studied.